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BARRICK RESOURCES (USA), INC.
MERCUR GOLD MINE
BIOSOLIDS LAND APPLICATION
DEMONSTRATION PROJECT

November 1, 1993

Prepared for:

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BARRICK RESOURCES (USA), INC.
MERCUR GOLD MINE
BIOSOLIDS LAND APPLICATION
MINED LAND RECLAMATION DEMONSTRATION PROJECT

1.0 Introduction

This project plan for the application of sewage sludge biosolids to mined land at the Barrick Mercur Gold Mine, Mercur, Utah has been prepared by the owner of the proposed application site and the person who will apply the bulk sewage sludge, Barrick Resources (USA) Inc., Mercur Mine, P.O. Box 838, Tooele, Utah 84074, UPDES Permit UT0023884, Phone (801) 268-4447. It has been prepared in response to agency comments on the Barrick September 3, 1993 conceptual proposal for biosolids application. Comments issued to Barrick from the Utah Division of Water Quality (DWQ) and the Division of Oil, Gas and Mining (DOGM) on September 24 and October 14, 1993 respectively are addressed in this more detailed proposal. This is also being submitted to the DWQ in support of the permit application for the treatment works, Orem City Water Reclamation Department, 1797 W. 1000 S., Orem, Utah 84058, UPDES Permit UT0020915, Phone (801) 224-7117, in compliance with 40 CFR Parts 122 and 124 and 40 CFR Part 503. The treatment works is owned by Orem City Corporation, 56 N. State Street, Orem, UT 84057.

1.1 Site Description

The demonstration project will take place on the Carrie Steele waste rock dump located at the Barrick Mercur Gold Mine, Mercur, Utah. This waste rock dump is located in the SW 1/4, Section 6, T.6 S., R.3 W., SLBM; Latitude 40° 20' 00" North, Longitude 112° 12' 30" West, Tooele County, Utah. The waste rock dump covers approximately 35.5 acres on a south to southwest facing mountain slope. The elevations at the toe of the dump slopes are approximately 6,700 feet AMSL and the elevations of the top of the dump are approximately 7,100 feet AMSL. The outer slope of the dump ranges from approximately 1.4h:1v to 1.7h:1v. The top of the dump is roughly flat and the outer edge of the dump top has been rounded to blend with the outer slope. The waste material comprising the dump includes limestone, sandstone, mudstone, clay, and soil. The coarser limestone material produces a rough, open surface which is resistant to weathering while the other materials tend to produce smoother, more compact surfaces which weather to soil-like clayey material that forms hard crusts when dry.

Past attempts to reclaim similar dump surfaces at Mercur with hydroseeding alone have met with little success. Topsoiling of the outer Carrie Steele dump slopes was attempted in the summer of 1993. The dry topsoil was gradually dropped onto the slope with a backhoe. It quickly ran to the bottom of the slope and accumulated at the toe with little, if any, being retained on the slope itself.

In response to the management practices requirements of 40 CFR 503.14(a), the environmental baseline characteristics of the entire Mercur Mine site, including the proposed demonstration project area, have been fully described in past in documents submitted to the Division of Oil, Gas and Mining. These data indicate that the application of the bulk sewage sludge will not adversely affect a threatened or endangered species or its designated critical habitat.

In response to the requirements of 40 CFR 503.14 (b) and (c), there are no wetlands at or near the proposed demonstration site so there is no possibility that bulk sewage sludge will enter a designated wetland. The closest ephemeral stream channel that could be interpreted to contain water of the United States, is the channel in the bottom of Mercur Canyon itself. This channel is 800 feet or more north, and downhill of the demonstration site. The ephemeral tributaries connecting the demonstration site with the Mercur channel have been equipped with silt fences and flow at these fences is monitored during large precipitation events. Past monitoring of these stations indicates there has never been any flow of water in these tributaries to the main Mercur Canyon channel even under snowmelt or extreme precipitation events. Therefore, it is unlikely that any bulk sewage from the demonstration site will enter waters of the United States.

In accordance with 40 CFR 503.20, the proposed demonstration site would not be considered an active sewage sludge unit because the applied sludge will be applied only once and then will remain on site over two years with no additions of sludge.

1.2 Project Objectives

The principal objective is to determine if application of different amounts of sewage sludge to the surface of the dump, along with hydroseeding, will result in improved revegetation success. The purpose of the sludge application would be to form a thin, nutrient-rich, seedbed on top of the dump surface which would aid in the germination and growth of the revegetation species. If this use of sewage sludge is shown to be technically viable and environmentally acceptable to the application regulatory agencies, a secondary objective would be to demonstrate a viable surface disposal option for sewage sludge.

1.3 Sludge Generator and Source

The applicable "treatment works treating domestic sewage" as defined in 40 CFR 122.2, is the Orem Water Reclamation sewage treatment plant located at 1797 West, 1000 South, Orem, Utah.

The sludge that will be used in this demonstration project will be obtained from a stockpile of dried aerobic sludge at the Orem plant.

1.4 Overall Project Construction Schedule

Barrick desires to install the demonstration project components before winter snows cover the site. The estimated latest date for construction of the demonstration project due to adverse winter weather is November 15, 1993. The main controlling factor is snow accumulation on the ground surface which would prevent application of sludge and other materials. The overall project schedule is shown below:

Start Detailed Project Planning	10/06
Soil Sampling	10/11
Sludge Sampling	10/15
Draft Project Plan Completed	10/22
Start Layout of Test Plots	10/25
Submit Project Plan to Agencies	11/01
Mobilize Equipment to Site	11/8
Begin Sludge Application	11/12
Complete Construction	11/24

2.0 Analyses of Materials

The specific sampling and analytical directions of the DWQ and DOGM were generally followed in obtaining analyses of the waste dump surface that would be treated, the topsoil that would be used in one of the test plot applications, and the sludge that would be applied to all non-topsoiled, and non-control test plots. Some deviations to the waste dump sampling, as specified by the DWQ, were required because of the material properties. The analytical parameters that were investigated on all three of the materials are listed in Table 2.0-1.

Table 2.0-1 Analytical Parameters

Total As, Cd, Cr, Cu, Pb, Hg, Mo, Ni, Se, Zn
pH
Sodium Adsorption Ratio (SAR)
Electrical Conductivity (EC)
Nitrate Nitrogen
Nitrite Nitrogen
Total Kjeldahl Nitrogen
Ammonia Nitrogen

Table 2.0-1 Analytical Parameters (continued)

Organic Nitrogen
Water Holding Capacity
Cation Exchange Capacity (CEC)
Acid-Base Analyses (ABP) (soil and waste rock only)
% Organic Matter (OM)
Texture (sand, silt, gravel)
Phosphorus
Potassium
DTPA Extractable Fe, Zn, Cu, Mn, Cd, Pb, Ni, Cr
Saturation Extractable Ca, Na, Mg
Carbon to Nitrogen Ratio (soils and sludge only)
Fecal Coliform (sludge only)

2.1 Waste Dump Sampling

The fines on the face of the waste rock dump slopes were sampled by obtaining six composite samples from six random sites. Generally the fines occurred as a shallow layer over the rock and rock debris of the slopes. The lab results are depicted in Table 2.1-1.

Table 2.1-1 Waste Rock Fines Characteristics (mg/kg unless shown)

Parameters	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Means
pH	7.86	8.04	7.96	7.74	7.88	7.85	7.89**
SAR	0.43	3.43	0.18	0.71	0.24	0.81	0.97
EC	1,451	2,580	440	1,095	164	1,378	1,185
nitrate-N	8.61	22.5	6.37	5.72	7.13	9.36	9.95
Water Holding Capacity %	11.2%	19.4	15.6	11.6	11.3	18.5	14.6
CEC	7.84	13.2	7.08	10.7	10.1	7.68	9.4
acid-base tons $CaCO_3$ /1000 tons	248	158	183	258	235	174	209

Parameters	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Means
C:N Ratio	34.5:1	28.8:1	32.7:1	20.8:1	23.3:1	35.8:1	29.3
O.M. %	0.806	0.271	0.528	1.02	0.33	0.922	0.65
Texture							
% rock	33.9	31.4	53.9	31.9	47.8	49.7	41.4
% sand	54.5	59.4	35.9	56.8	45.4	41.8	49.0
% si/cl	11.6	9.2	10.2	11.3	6.8	8.5	9.6
Phosphate	<0.1	0.851	0.181	0.271	0.214	0.124	0.28
Potassium	16.2	45.1	157	35.7	117	40.6	68.6
Calcium*	867.0	306.0	194	537	128	566	433
Sodium*	49.1	256.0	10.7	64.1	11.7	74.2	77.6
Magnesium*	78.3	71.1	51.9	54.6	32.3	44.6	55.5
DPTA Fe	208	39.5	51.3	110.0	85.4	169.0	110.5
DPTA Zn	1.11	0.76	1.54	2.01	0.66	2.45	1.42
DPTA Cu	0.63	0.42	0.29	0.21	0.22	0.50	2.27
DPTA Mn	13.2	7.0	7.60	7.19	3.24	9.74	7.99
DPTA Cd	0.14	<0.1	<0.1	0.11	<0.1	<0.1	0.10
DPTA Pb	0.40	0.68	0.63	0.35	0.61	0.76	0.57
DPTA Ni	1.23	0.59	1.03	0.76	0.52	1.97	1.07
DPTA Cr	0.31	0.27	0.23	0.17	0.20	0.26	0.24

* Saturation Extract
** pH value is logarithm so mean is artificial
See Appendix for individual lab reports

The soil-like material of the waste dumps is best described as moderately alkaline stony, loamy sand. The fines are only about 16% so the material naturally has a low inherent fertility and water holding capacity. The small amount of organic matter and fines indicates most of the nutrients are salts from mineral decomposition. The salt load is not high and composed mostly of calcium salts although one sample had a moderate amount of sodium. The macronutrients are low except for calcium (moderate) and phosphates which are almost non-existent. The DPTA extract (simulating plant extraction from the soil) indicates iron is average and all the other metals have low concentrations.

2.2 Soil Sampling

The material to be used as topsoil or growth medium for the test plots is from stockpiles of Ant Flat and Bezzant soils. The soil characteristics are shown in Table 2.2-1. These data were obtained from various soil lab tests conducted during the mine permitting process.

Table 2.2-1 Topsoil or Growth Medium Characteristics didn't run topsoil

Soil Parameter	Ant Flat	Bezzant
% sand	41.0	13.0
% silt	29.0	47.0
% clay	30.0	40.0
pH (range)	6.9-7.9	7.6-7.9
Na (ppm)	1.37	0.30
Ca (ppm)	2.84	1.78
Mg (ppm)	1.23	0.43
SAR	0.96	0.29
% Organic Matter	1.0	2.3

The Ant Flat soil is a clay loam while Bezzant is more of a silty clay loam. The Ant Flat soils are neutral to mildly alkaline and low in organic matter. The Bezzant soils are moderately alkaline and moderately low in organic matter. Both soils have salts dominated by calcium; the phosphate level is unknown and probably is low to very low.

2.3 Sludge Sampling

Seven samples of the dried aerobic digestion sludge that will be used on the test plots were taken in October, 1993. These were analyzed for fecal coliform at Interwest Analytical Laboratory, Lindon, UT. The results of these analyses are shown in Table 2.3-1 and the lab reports are included in the appendix. The geometric mean of the density of fecal coliform in the samples was <50 MPN per gram of dry sample.

Another sample of the dried aerobic digestion sludge to be used on the test plots was taken and sent to Chemtech Analytical Laboratory, Salt Lake City, Utah for analyses of the parameters listed in Table 2.0-1. The results of these analyses are included in Table 2.3-2 and the laboratory reports are included in the appendix.

Table 2.3-1 **Fecal Coliform Analyses of Sludge** (MPN/g dry wt.)

Sample #	Coliform Count
3	< 50
4	< 50
5	< 50
6	< 50
7	< 50
8	< 50
9	< 50
Mean	< 50

Table 2.3-2 **Chemical Analyses of Sludge** (mg/kg unless shown)

Arsenic	<4.0
Cadmium	2.58
Chromium	24.7
Copper	165
Lead	16.2
Mercury	1.47
Molybdenum	<4.0
Nickel	6.87
Selenium	4.66
Zinc	304
pH	7.12
Sodium Adsorption Ratio	4.92
Electrical Conductivity	1,465
Nitrate Nitrogen	5.0
Nitrite Nitrogen (sol.)	1.5
Nitrate + Nitrite	6.48
Total Kjeldahl Nitrogen	11,700
Ammonia Nitrogen	1,590
Organic Nitrogen	10,110
Water Holding Cap. (%)	197
CEC (meq/100 gm)	53.2
% Organic Matter	>15
Total Carbon	175,000

Table 2.3-2 Chemical Analyses of Sludge (Continued) (mg/kg unless shown)

Ortho Phosphate (sol.)	108
Potassium (sol.)	182
DTPA Extractable:	
Fe	349
Zn	41.6
Cu	4.58
Mn	10.2
Cd	0.31
Pb	4.48
Ni	1.38
Cr	0.5
Saturation Extractable:	
Ca	119
Na	235
Mg	32.8
Carbon to Nitrogen Ratio	14.96

On August 25, 1993, samples were taken of the aerobic and anaerobic sludge from the thickeners for these systems. These were analyzed for nutrients and TCLP metals. The results of these analyses are included in Table 2.3-3 and the laboratory report is included in the appendix.

Table 2.3-3 Nutrient and Waste Analyses of Sludge

	Aerobic	Anaerobic
Water Sol. Potassium (mg/kg)	120	56.7
Water Sol. TKN	140	780
Water Sol. Phosphorus	115	45.0
TCLP Test:		
Arsenic (mg/l)	<0.04	<0.04
Barium -?	4.12	5.89
Cadmium	0.01	<0.01
Chromium	<0.01	<0.01
Lead	0.048	<0.02
Mercury	<0.002	<0.00033
Selenium	<0.04	<0.04
Silver -?	<0.01	<0.01

? Copper, Molybdenum, Nickel, Zinc

3.0 Test Plot Design

The test plot design will follow scientific methods to provide sufficient replication of the various sludge treatments so sampling results can be statistically tested. The goal of the overall design is to provide data on vegetative growth, soil chemistry and the affects on surface and ground waters relative to sludge amendment of a growth medium.

3.1 Site Characteristics

The surface of the site is composed of material grading from large rocks through fine materials derived from the recent decomposition of waste rock material. The fine materials tend to be clayey and spread thinly (2-3" deep) over most sections of the dump surface. The various waste rock materials are not evenly distributed on the dump surface and tend to form zones of mixed or dominant materials. The distribution of these different materials has been mapped on the waste dump surface. This mapping will assist in determining the base materials and their influence on the testing in the plots. Table 3.1-1 is a description of the zones based on the composition of the surface material.

Table 3.1-1 Waste Rock Dump Surface Composition

Zone	Surface Acres	Percent Composition	Limestone Acres	Sandstone/ Mudstone Acres	Clay Acres	Fines Acres
1,7,10	1.87	95% limestone	1.77			0.10
		5% fines				
2	4.84	50% limestone	2.42			
		35% fines		0.73		
		15% mudstone				1.69
3,9	0.16	40% fines				0.07
		30% limestone	0.05			
		15% sandstone		0.02		
		15% clay			0.02	
4	1.82	65% limestone	1.18			
		20% fines				0.36
		8% mudstone		0.15		
		7% clay			0.13	
5	3.72	60% fines				2.23
		30% limestone	1.12			
		5% clay			0.19	
		5% mudstone		0.19		

6	1.24	50% fines				0.69
		20% limestone	0.40			
		10% clay			0.14	
		10% mudstone		0.14		
8	21.72	60% fines				13.03
		20% limestone	4.34			
		15% mudstone		3.26		
		5% clay			1.09	

3.2 Test Plot Layout and Proposed Sludge Application Rates

Three test plot areas will be sited across the face of the dump mostly on the south-southwest aspects (Figure 1). Since each plot will be identical in design three replications will be provided. Replications are necessary to provide sufficient area and sites to overcome the variations of the dump surface. Replications also reduce the risks that all the sites will be influenced by one or more dominant environmental factors.

A second desirable characteristic of test plot design is to have sufficient area to increase sampling efficiency and also to reduce the undue influence of an overriding environmental factor. Within each test plot area will be an area of 400 feet wide by at least 300 feet long that will be used as the monitored test plot (Figure 2). The size of the monitored test plots will incorporate all of the area of the dump suitable for testing considering aspect and slope length. The test plots are sited to include at least 100 feet of the flat top and 200 feet of the steep slope. A break at the rounded lip of the dump is not included in the monitored test plot because the gradual rounded slope is not characteristic of the flat top or the steep dump slope, and also is too small of an area to sample.

Each monitored test plot will then be subdivided into five subplots. The control subplot would include only hydroseeding untreated waste rock. The topsoiled subplot would be covered with a minimal amount (6 inches) of non-amended topsoil cover and hydroseeded. The other three subplots would contain three levels of sludge-alfalfa hay mixture. The sludge will be mixed with up to equal parts alfalfa hay in a slurry and applied evenly to the subplots with a hydroseeder.

The first proposed sludge application rate is 6 tons/acre (solids). The basis for this application rate is that it is a rate commonly used in agricultural applications. Numerous reports in the literature mention the agricultural application rate of sludge is 5 - 7 tons/acre.

The second proposed rate is 18 tons/acre (solids), an increase needed to adequately amend non-agricultural soils. This application rate is a medium of those rates reported in the literature to successfully treat reclaimed sites where topsoils are of poor quality or soils are not present. In the latter case, a growth medium was amended with sludge to obtain productive plant growth. The lack of topsoils on the waste rock dump is similar to the situations in the literature where topsoils or even soils are not present for revegetation.

The third proposed rate is 36 tons/acre (solids), a rate mentioned in the literature to amend sites with insufficient growth medium to support a vegetative cover. For sites where no soil material is present and physical conditions do not allow plants to colonize the site, heavier application of sludge is required, often mixed with another material to provide bulk. This application rate will be tested to see if it can provide a more suitable seedbed for germination than the lighter applications.

The subplots would be aligned to include 80 x 100 feet of the flat dump top and 80 x 200 feet of the steep dump slope so both sites can be adequately tested as the main components of unreclaimed waste rock dumps.

Outside the monitored test plots, additional sludge-alfalfa hay mixture would be applied to the dump at a rate of approximately 18 tons/acre (solids). This material would be obtained directly from the drying beds at the Orem treatment plant. Analytical information for this sludge is not yet available but these data will be supplied to the DWQ for approval prior to the sludge being applied to the rest of the waste rock dump.

3.3 Test Plot Construction

The plot sites will be staked on the ground by measurement and survey to accurately determine the length and orientation of each plot and subplot. The corners of the subplots and a point every 100 feet along the borders of the subplots will be permanently marked with a 6-foot steel "t" post driven into the ground a minimum of one foot so the blade is buried in a firm bed. A six foot steel "t" post will be located at the midpoint of the north boundary of test plots to carry a 3' x 3' sign with the following information:

CARRIE STEELE WASTE ROCK DUMP
BIOSOLIDS RECLAMATION PROJECT
TEST PLOT #
ESTABLISHED NOVEMBER, 1993
BARRICK MERCUR MINE

A 1'x 1' sign will also be posted at the midpoint of the north boundary of every subplot with the identification of the subplot i.e. Control, Topsoil, Sludge 6 Tons, Sludge 18 Tons, or Sludge 36 Tons.

Photo points will also be established permanently at the midpoint of each subplot on the north and south boundaries by placing a 3' high steel stake.

Once all of the corners, boundaries, signs and photo points are permanently marked they will be plotted by survey and recorded in the files along with the survey notes so any one point can be re-established. During the applications of the sludge amended materials and hydroseeding and also when subsequent sampling is conducted the boundaries of the subplots will be marked by cords connected to the posts.

3.4 Treatment Application

The treatment goal is to ascertain the proper application rates of biosolids to facilitate the revegetation of the harsh environment of waste rock dumps. The routine hydroseeding of seed with mulch and fertilizers usually fails to establish a productive and diverse plant community able to stabilize the surface or through succession establish a functioning ecosystem. The amendment of sewage sludge with alfalfa hay will provide a growth medium high in organic matter with increased nutrient potential and water holding capacity. This growth medium will be in contact with the waste fines and through raveling and slope adjustment will become incorporated in the waste material. The biosolids will amend the rock fines and provide a greatly improved seedbed for the establishment of vegetation on the slopes. Fertilizer as required will be added to balance any nutrient deficiencies in the sludge amended areas.

Once the subplots have received the respective sludge applications all of the subplots will be hydroseeded uniformly. The hydroseeding will consist of a seed mix in a slurry. The seed mix was derived from various seed mixes used or recommended for use at the Mercur Mine. The seed mix is composed of both pioneering species and species used for erosion control (Table 3.4-1). The seed mix also reflects those species most likely to survive on south aspects and/or on rocky slopes.

Table 3.4-1 Test Plot Seed Mix

Common Name	Scientific Name	PLS lbs/acre
western wheatgrass	Elymus smithii	4.0
thickspike wheatgrass	Elymus dasystachyum	4.0
bluebunch wheatgrass	Elymus spicatum	4.0
bottlebrush squirreltail	Elymus elymoides	1.0
Russian wildrye	Elymus junceus	1.0
Palmer penstemon	Penstemon palmerii	1.0
Lewis blue flax	Linum lewisii	2.0
Cicer milkvetch	Astragalus cicer	2.0
ladak alfalfa	Medicago sativa	2.0
black sagebrush	Artemisia nova	0.25
rubber rabbitbrush	Chrysothamnus nauseosus	1.0
four-wing saltbush	Atriplex canescens	2.0
Total		24.25

The nitrogen demand of this seed mix is approximately 50 pounds per acre.

4.0 Sludge Handling

The sludge to be used will be aerobic treatment sludge that has been dried in drying beds at the Orem treatment plant. This material will be loaded into trucks and hauled to the demonstration site.

4.1 Vector Attraction Reduction

All of the sludge that will be used for the test plots will meet the aerobic treatment requirements of 40 CFR 503.33 (b)(4). The sludge will have been treated in an aerobic process for an adequate time such that the specific oxygen uptake rate (SOUR) will be equal to or less than 1.5 mg of oxygen per hour per gram of total biosolids (dry weight basis) at a temperature of 20°C.

The sludge will meet the Class B requirements for Alternative 1 (see results of Section 2.3 above).

The demonstration project will be operated in accordance with the site restrictions for Class B sludge, 40 CFR 503.32 (b)(5). There will be no food crops grown on the site. Domestic animals will not be allowed to graze on the demonstration project for at least 30 days after application of the bulk sewage sludge. There will be no turf grown on the demonstration site. Public access will be restricted for at least one year following application of the sewage sludge.

4.2 Amounts

Based on the size of the test plots and the proposed application rates, it is anticipated that approximately 100 tons of sludge solids will be required for the test plots portion of the project. Another 200 tons of sludge will be applied to the rest of the mine dump to help with reclamation of it. Based on the application capability of the hydroseeding contractor, the sludge will be applied at a daily rate of approximately 24 TPD.

4.3 Transportation

The sludge will be hauled to the demonstration site in trucks owned or contracted by the treatment works. The sludge from the drying beds will be loaded at the treatment works into dump bed trailers which will be covered and hauled to the site. At the site these will be dumped in a designated location at the top of the dump to temporarily stage the material before loading it in the sludge application machine. Typically, only enough sludge will be staged on site to satisfy 24 hours worth of application.

4.4 Application Method

At the top of the site, the sludge will be mixed with water in a hydroseeder tank to a slurry of about 30% solids which will then be sprayed on the ground with the hydroseeder nozzle. The hydroseeder that will be used will be operated by a contractor who is experienced in applying sewage sludge with this method. The equipment will have the ability to place material on all areas of the demonstration site. Multiple applications of sludge will be made until the necessary thickness for each test plot has been achieved.

5.0 Monitoring

The construction and status of the site following construction will be monitored by Barrick personnel assisted by JBR Consultants Group, Salt Lake City. The purpose of this monitoring is to comply with the requirements of the demonstration project approvals by the DWQ and DOGM, the Pollution Prevention Plan developed under UPDES Permit UT0023884, and the applicable requirements of 40 CFR Part 503.

The monitoring plan is designed to sample the progress of the test plots and to ascertain any affects on the surrounding environment. The monitoring is intended to continue for five years depending on the results achieved and may be extended should the cooperating parties agree that further monitoring is required to complete the test program. An annual report on monitoring will be distributed 30 days following the calendar year to be reported. The annual report will consist of:

1.0 Introduction
2.0 Treatment Project Conditions and Meteorological Data
3.0 Vegetation Data and Plant Succession Status
4.0 Soil Testing
5.0 Surface Water and Erosion Data
6.0 Ground Water Data
7.0 Summary
Appendices

5.1 Construction Quality Control

Representatives of the Barrick Environmental Department and JBR Consultants will monitor the construction of the demonstration site. The layout of the test plots, the survey control and the application of treatments will be monitored during working hours by qualified JBR personnel. The person(s) monitoring the construction will supervise all phases of the construction and approve of the methods and materials to be used onsite. All test plots and subplots will be re-measured after initial construction to assure all dimensions are correct.

The quality of the seed will be checked by requiring the vendor to provide a certification of the types and quantities of PLS in the seed mix. The amount of seed used will be noted to determine that the specified application rate is adhered to.

The type and amount of soil amendments that are applied, including mulch and fertilizer, will be checked.

The total gallons and/or tons of sewage sludge that is delivered to the site will be recorded. The amount of this material that is applied to each test plot on the site will be monitored to ensure proper application rates. The uniformity of the application will be checked by visually inspecting the test plot areas during application.

The amending of the soil and applications of the three sludge rates will be carefully checked during mixing and application to ensure the quantities are correct and the applications rates and methods follow the test plot designs. After the treatment applications the supervisor will re-check the rates and depths of the applied material and record these for each subplot. The supervisor will closely observe activities around the control subplots to ensure amended materials are not applied to these subplots. The supervisor will also observe the hydroseeding procedure to ensure the materials and applications are equal to specifications.

All notes and photographs of the construction activities will be retained. Following the completion of the construction and applications, the quality control supervisor will provide a report, from his daily journal, on the operations and the measurements of the plots and applications.

5.2 Monitoring Plan

Vegetation

The use of the photo plot stations at each subplot will provide a visual record of the progress of each treatment at each replication. The photos at each station will include an overall shot of the subplot and a close-up shot of the vegetation within the photo plot. The photo plot consists of a 1' x 1' white background board with a 1' x 1' frame in the foreground surrounded by a larger 2' x 4' frame. One photo is taken close-up of the backboard and the small frame and the second photo then encompasses the larger frame and the subplot as background. The photos will be shot annually during the late summer except for the first growing season when photos will be taken in the late spring and late summer to closely follow the progression of the early plant growth.

The vegetation sampling will include both qualitative and quantitative methods. The qualitative methods include monthly site visits in the first growing season, bimonthly site visits in the second growing season and quarterly site visits in the following growing seasons. During each site visit the progress of the vegetative growth will be recorded for each subplot as will the soil conditions, erosion, livestock or wildlife use, insect infestations and other special conditions.

The quantitative sampling will consist of random line intercept transects in each subplot. Sampling of total vegetation cover and frequency will be done to meet a 90% confidence level with a 10% change in the mean using a standard one-tailed "t" test. Random starting locations for each subplot will be determined from a grid table of the subplot and use of a random number generator. The transect consists of a 50' tape with 1 foot increments. This will provide 50 feet per transect to determine the species composition of the vegetative cover.

The vegetative cover is measured by recording the length of intercept on the transect line for all plant species at all intercepts along the 50 foot transect. All the vegetation in a vertical line from the ground level to a height of one meter is recorded. Where vegetative cover is absent the non-vegetative element is recorded as either bare soil, rock (larger than 3" diameter) or litter. The species frequency is gained from the recording of the species within the vertical plane of the line. The species composition of the vegetative cover is expressed as a percentage distribution. The vegetative cover is expressed as a percent of the total samples and non-vegetative cover is subdivided in the percentage distribution of soil, rock and litter. Vegetation transects should be measured annually in the late summer starting with the second growing season to record the changes in cover and species composition as the treatment matures.

Quantitative sampling also includes measurements of the productivity of each subplot. At the end of the third growing season two belt transects will be permanently established in each subplot. The belt transects are 100 feet in length and one meter in width. Plots of one meter square are clipped at 10 foot intervals along the belt transect so each transect yields 10 clippings. All the growth of graminoids and forbs and the annual growth of the shrubs are clipped. The clippings are dried and weighed to determine the relative productivity of each subplot.

Soil Chemistry

The general soil surface conditions will be noted in the site visits. The soil of the subplots will be sampled annually. The soil is defined as all the soil-like surface material that may be composed of amended soil materials and fines from the waste rock materials. A soil sample consists of a vertical 6-inch composite sample or if soils are less than 6 inches deep then the entire depth available in a composite sample.

The soil samples will be tested for the parameters listed in Section 2.1 unless the continued testing does not reveal any or only very minuscule levels of a chemical constituent.

The data from the lab analysis will be discussed in the annual report with respect to vegetative growth and water analysis.

Erosion

Erosion of soil, soil amendments and/or sewage sludge is possible, especially on the steep outer slopes of the demonstration site. Visual observations will be made of the top and slopes of the demonstration site on a quarterly basis and shortly after any precipitation event in excess of 1.0 inches. The inspection of the top surface of the site will be made by a walking traverse of the perimeter of the top looking for any rills, gullies, sheetwash or other evidence of erosion. These will be described in a notebook and photographed. The inspection of the slopes will be made by a walking traverse of the top and bottom of the slope looking for any rills, gullies, sheetwash, deposits of sediment, or other evidence of erosion. These will be described in a notebook and photographed.

Evidence of significant erosion will be discussed between mine personnel and JBR Consultants to determine if mitigative actions are warranted and practicable. Such mitigative actions may be undertaken if erosion damage to the demonstration site is considered to be excessive.

Water Quality

In compliance with Part I.E. of its Utah Pollution Discharge Elimination System (UPDES) permit No. UT0023884, Barrick will control stormwater discharges from the demonstration site (Site D in the permit) through the use of silt fences which have been constructed in the two ephemeral drainages below the mine dump. The silt fences will be visually inspected at least annually to evaluate their effectiveness. According to the Stormwater Pollution Prevention Plan (SPPP) for the mine, a record of flow from these drainages will be made in the event that a precipitation event in excess of 1.0 inches is measured at the mine. If flow is observed, a grab sample of the flow will be obtained within the first 30 minutes of the discharge, and if practicable, a composite sample will be obtained for the first 24 hours of flow. Samples will be analyzed by a Utah-Certified laboratory for the parameters required in Part I.D.1. of the UPDES permit, specifically:

Suspended Solids
Oil & Grease
Total Cadmium
Total Copper
Mercury
Total Lead
Total Zinc
Total Cyanide
Nitrate
Sulfate
Total Dissolved Solids
pH

In addition to reporting to the DWQ the results of such analyses, Barrick will report the date and duration of the storm event sampled, rainfall measurements or estimates of the storm event which generated the sampled runoff, the duration between the storm event sampled and the end of the previous measurable storm event (>0.1 inch), and an estimate of the total volume of the discharge sampled.

5.3 Monitoring Schedule

The proposed monitoring schedule for the test plots is shown in Table 5.3-1.

Table 5.3-1 Test Plot Monitoring Schedule

Parameter	Year 1	Year 2	Year 3	Year 4	Year 5
Site Visit	monthly	bi-monthly	quarterly	quarterly	quarterly
Vegetation					
photos	2/season	annually	annually	annually	annually
quantitative	none	summer	summer	summer	summer
Soil	summer	summer	summer	summer	summer
Surface Water	by permit	by permit	by permit	by permit	by permit

CHEMTECH

ANALYTICAL LABORATORY

6100 S. STRATLER
MURRAY, UTAH 84107
PHONE: (801) 262-7299
FAX: (801) 262-7378

TO: JBR Consultants
8160 S. Highland Dr. STE A-4
Sandy, Utah 84093

DATE: 10-15-93

SAMPLE ID: Lab #U100580 - Barrick Mercur Snyder Dump, #1

DATE SAMPLED: 10-11-93

DATE SUBMITTED: 10-11-93

CERTIFICATE OF ANALYSIS

PARAMETER	DETECTED
pH Units	7.86
SAR	0.43
Conductivity, uhmos/cm	1,451
Nitrate + Nitrite as NO_3-N + NO_2-N, mg/Kg	8.61
% Water Holding Capacity	11.2
Cation Exchange Capacity	7.84
Max. Acid Potential, tons CaCo3/1000 tons	0.46
Acid Base Potential, tons $CaCo_3$/1000 tons	248
Gross Neutral Potential, tons $CaCo_3$/1000 tons	248
% Organic Matter	0.806
Phosphate as PO_4-P (Water Sol.), mg/Kg	<.1
Potassium as K (Water Sol.), mg/Kg	16.2
Calcium as Ca (Water Sol.), mg/Kg	867
Sodium as Na (Water Sol.), mg/Kg	49.1
Magnesium as Mg (Water Sol.), mg/Kg	78.3
Sieve % Rock	33.9
% Sand	54.5
% Silt/Clay	11.6
Total Carbon, mg/Kg	31,210
TKN, mg/Kg	904
% Moisture	5.8

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TO: JBR Consultants
8160 S. Highland Dr. STE A-4
Sandy, Utah 84093

DATE: 10-15-93

SAMPLE ID: Lab #U100580 - Barrick Mercur Snyder Dump, #1

DATE SAMPLED: 10-11-93

DATE SUBMITTED: 10-11-93

CERTIFICATE OF ANALYSIS

PARAMETER	DETECTED
DTPA EXTRACTABLES:	
Iron as Fe, mg/Kg	208
Zinc as Zn, mg/Kg	1.11
Copper as Cu, mg/Kg	0.626
Manganese as Mn, mg/Kg	13.2
Cadmium as Cd, mg/Kg	0.145
Lead as Pb, mg/Kg	0.402
Nickel as Ni, mg/Kg	1.23
Chromium as Cr, mg/Kg	0.306

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TO: JBR Consultants
8160 S. Highland Dr. STE A-4
Sandy, Utah 84093

DATE: 10-15-93

SAMPLE ID: Lab #U100581 - Barrick Mercur Snyder Dump, #2
DATE SAMPLED: 10-11-93
DATE SUBMITTED: 10-11-93

CERTIFICATE OF ANALYSIS

PARAMETER	DETECTED
pH Units	8.04
SAR	3.43
Conductivity, uhmos/cm	2,580
Nitrate + Nitrite as NO_3-N + NO_2-N, mg/Kg	22.5
% Water Holding Capacity	19.4
Cation Exchange Capacity	13.2
Max. Acid Potential, tons CaCo3/1000 tons	0.34
Acid Base Potential, tons $CaCo_3$/1000 tons	158
Gross Neutral Potential, tons $CaCo_3$/1000 tons	158
% Organic Matter	0.271
Phosphate as PO_4-P (Water Sol.), mg/Kg	0.851
Potassium as K (Water Sol.), mg/Kg	45.1
Calcium as Ca (Water Sol.), mg/Kg	306
Sodium as Na (Water Sol.), mg/Kg	256
Magnesium as Mg (Water Sol.), mg/Kg	71.1
Sieve % Rock	31.4
% Sand	59.4
% Silt/Clay	9.2
Total Carbon, mg/Kg	22,940
TKN, mg/Kg	795
% Moisture	7.6

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TO: JBR Consultants
8160 S. Highland Dr. STE A-4
Sandy, Utah 84093

DATE: 10-15-93

SAMPLE ID: Lab #U100581 - Barrick Mercur Snyder Dump, #2

DATE SAMPLED: 10-11-93

DATE SUBMITTED: 10-11-93

CERTIFICATE OF ANALYSIS

PARAMETER	DETECTED
DTPA EXTRACTABLES:	
Iron as Fe, mg/Kg	39.5
Zinc as Zn, mg/Kg	0.758
Copper as Cu, mg/Kg	0.421
Manganese as Mn, mg/Kg	7.00
Cadmium as Cd, mg/Kg	<.1
Lead as Pb, mg/Kg	0.680
Nickel as Ni, mg/Kg	0.588
Chromium as Cr, mg/Kg	0.267

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TO: JBR Consultants
8160 S. Highland Dr. STE A-4
Sandy, Utah 84093

DATE: 10-15-93

SAMPLE ID: Lab #U100582 - Barrick Mercur Snyder Dump, #3

DATE SAMPLED: 10-11-93

DATE SUBMITTED: 10-11-93

CERTIFICATE OF ANALYSIS

PARAMETER	DETECTED
pH Units	7.96
SAR	0.18
Conductivity, uhmos/cm	440
Nitrate + Nitrite as NO_3-N + NO_2-N, mg/Kg	6.37
% Water Holding Capacity	15.6
Cation Exchange Capacity	7.08
Max. Acid Potential, tons CaCo3/1000 tons	0.57
Acid Base Potential, tons $CaCo_3$/1000 tons	183
Gross Neutral Potential, tons $CaCo_3$/1000 tons	183
% Organic Matter	0.528
Phosphate as PO_4-P (Water Sol.), mg/Kg	0.181
Potassium as K (Water Sol.), mg/Kg	157
Calcium as Ca (Water Sol.), mg/Kg	194
Sodium as Na (Water Sol.), mg/Kg	10.7
Magnesium as Mg (Water Sol.), mg/Kg	51.9
Sieve % Rock	53.9
% Sand	35.9
% Silt/Clay	10.2
Total Carbon, mg/Kg	29,130
TKN, mg/Kg	890
% Moisture	5.2

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TO: JBR Consultants
8160 S. Highland Dr. STE A-4
Sandy, Utah 84093

DATE: 10-15-93

SAMPLE ID: Lab #U100582 - Barrick Mercur Snyder Dump, #3

DATE SAMPLED: 10-11-93

DATE SUBMITTED: 10-11-93

CERTIFICATE OF ANALYSIS

PARAMETER	DETECTED
DTPA EXTRACTABLES:	
Iron as Fe, mg/Kg	51.3
Zinc as Zn, mg/Kg	1.54
Copper as Cu, mg/Kg	0.294
Manganese as Mn, mg/Kg	7.60
Cadmium as Cd, mg/Kg	<.1
Lead as Pb, mg/Kg	0.633
Nickel as Ni, mg/Kg	1.03
Chromium as Cr, mg/Kg	0.231

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TO: JBR Consultants
8160 S. Highland Dr. STE A-4
Sandy, Utah 84093

DATE: 10-15-93

SAMPLE ID: Lab #U100583 - Barrick Mercur Snyder Dump, #4

DATE SAMPLED: 10-11-93

DATE SUBMITTED: 10-11-93

CERTIFICATE OF ANALYSIS

PARAMETER	DETECTED
pH Units	7.74
SAR	0.71
Conductivity, uhmos/cm	1,095
Nitrate + Nitrite as NO_3-N + NO_2-N, mg/Kg	5.72
% Water Holding Capacity	11.6
Cation Exchange Capacity	10.7
Max. Acid Potential, tons CaCo3/1000 tons	0.12
Acid Base Potential, tons $CaCo_3$/1000 tons	258
Gross Neutral Potential, tons $CaCo_3$/1000 tons	258
% Organic Matter	1.02
Phosphate as PO_4-P (Water Sol.), mg/Kg	0.271
Potassium as K (Water Sol.), mg/Kg	35.7
Calcium as Ca (Water Sol.), mg/Kg	537
Sodium as Na (Water Sol.), mg/Kg	64.1
Magnesium as Mg (Water Sol.), mg/Kg	54.6
Sieve % Rock	31.9
% Sand	56.8
% Silt/Clay	11.3
Total Carbon, mg/Kg	31,835
TKN, mg/Kg	1,530
% Moisture	6.0

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TO: JBR Consultants
8160 S. Highland Dr. STE A-4
Sandy, Utah 84093

DATE: 10-15-93

SAMPLE ID: Lab #U100583 - Barrick Mercur Snyder Dump, #4

DATE SAMPLED: 10-11-93

DATE SUBMITTED: 10-11-93

CERTIFICATE OF ANALYSIS

PARAMETER	DETECTED
DTPA EXTRACTABLES:	
Iron as Fe, mg/Kg	110
Zinc as Zn, mg/Kg	2.01
Copper as Cu, mg/Kg	0.211
Manganese as Mn, mg/Kg	7.19
Cadmium as Cd, mg/Kg	0.107
Lead as Pb, mg/Kg	0.354
Nickel as Ni, mg/Kg	0.757
Chromium as Cr, mg/Kg	0.168

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TO: JBR Consultants
8160 S. Highland Dr. STE A-4
Sandy, Utah 84093

DATE: 10-15-93

SAMPLE ID: Lab #U100584 - Barrick Mercur Snyder Dump, #5

DATE SAMPLED: 10-11-93

DATE SUBMITTED: 10-11-93

CERTIFICATE OF ANALYSIS

PARAMETER	DETECTED
pH Units	7.88
SAR	0.24
Conductivity, uhmos/cm	164
Nitrate + Nitrite as NO_3-N + NO_2-N, mg/Kg	7.13
% Water Holding Capacity	11.3
Cation Exchange Capacity	10.1
Max. Acid Potential, tons CaCo3/1000 tons	0.02
Acid Base Potential, tons $CaCo_3$/1000 tons	235
Gross Neutral Potential, tons $CaCo_3$/1000 tons	235
% Organic Matter	0.327
Phosphate as PO_4-P (Water Sol.), mg/Kg	0.214
Potassium as K (Water Sol.), mg/Kg	117
Calcium as Ca (Water Sol.), mg/Kg	128
Sodium as Na (Water Sol.), mg/Kg	11.7
Magnesium as Mg (Water Sol.), mg/Kg	32.3
Sieve % Rock	47.8
% Sand	45.4
% Silt/Clay	6.8
Total Carbon, mg/Kg	31,060
TKN, mg/Kg	1,330
% Moisture	7.5

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8160 S. Highland Dr. STE A-4
Sandy, Utah 84093

DATE: 10-15-93

SAMPLE ID: Lab #U100584 - Barrick Mercur Snyder Dump, #5

DATE SAMPLED: 10-11-93

DATE SUBMITTED: 10-11-93

CERTIFICATE OF ANALYSIS

PARAMETER	DETECTED
DTPA EXTRACTABLES:	
Iron as Fe, mg/Kg	85.4
Zinc as Zn, mg/Kg	0.662
Copper as Cu, mg/Kg	0.220
Manganese as Mn, mg/Kg	3.24
Cadmium as Cd, mg/Kg	<.1
Lead as Pb, mg/Kg	0.606
Nickel as Ni, mg/Kg	0.519
Chromium as Cr, mg/Kg	0.197

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TO: JBR Consultants
8160 S. Highland Dr. STE A-4
Sandy, Utah 84093

DATE: 10-15-93

SAMPLE ID: Lab #U100585 - Barrick Mercur Snyder Dump, #6

DATE SAMPLED: 10-11-93

DATE SUBMITTED: 10-11-93

CERTIFICATE OF ANALYSIS

PARAMETER	DETECTED
pH Units	7.85
SAR	0.81
Conductivity, uhmos/cm	1,378
Nitrate + Nitrite as NO_3-N + NO_2-N, mg/Kg	9.36
% Water Holding Capacity	18.5
Cation Exchange Capacity	7.68
Max. Acid Potential, tons CaCo3/1000 tons	1.14
Acid Base Potential, tons $CaCo_3$/1000 tons	174
Gross Neutral Potential, tons $CaCo_3$/1000 tons	175
% Organic Matter	0.922
Phosphate as PO_4-P (Water Sol.), mg/Kg	0.124
Potassium as K (Water Sol.), mg/Kg	40.6
Calcium as Ca (Water Sol.), mg/Kg	566
Sodium as Na (Water Sol.), mg/Kg	74.2
Magnesium as Mg (Water Sol.), mg/Kg	44.6
Sieve % Rock	49.7
% Sand	41.8
% Silt/Clay	8.5
Total Carbon, mg/Kg	27,385
TKN, mg/Kg	764
% Moisture	6.5

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TO: JBR Consultants
8160 S. Highland Dr. STE A-4
Sandy, Utah 84093

DATE: 10-15-93

SAMPLE ID: Lab #U100585 - Barrick Mercur Snyder Dump, #6

DATE SAMPLED: 10-11-93

DATE SUBMITTED: 10-11-93

CERTIFICATE OF ANALYSIS

PARAMETER	DETECTED
DTPA EXTRACTABLES:	
Iron as Fe, mg/Kg	169
Zinc as Zn, mg/Kg	2.45
Copper as Cu, mg/Kg	0.497
Manganese as Mn, mg/Kg	9.74
Cadmium as Cd, mg/Kg	<.1
Lead as Pb, mg/Kg	0.765
Nickel as Ni, mg/Kg	1.97
Chromium as Cr, mg/Kg	0.265

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TO: JBR Consultants
8160 S. Highland Dr. STE A-4
Sandy, Utah 84093

DATE: 10-25-93

SAMPLE ID: Lab #U100924 - Orem Sewage Treatment Plant, Sewage Sludge

DATE SUBMITTED: 10-15-93

CERTIFICATE OF ANALYSIS

PARAMETER	DETECTED
pH Units	7.12
SAR	4.92
Conductivity, uhmos/cm	1,465
Nitrate + Nitrite as NO_3-N + NO_2-N, mg/Kg	6.48
Nitrate as NO_3-N, mg/Kg	5.0
Nitrite as NO_2-N (Water Soluble), mg/Kg	1.5
Ammonia as NH_3-N, mg/Kg	1,590
TKN, mg/Kg	11,700
Cation Exchange Capacity, meq/100 gm	53.2
% Organic Matter	>15
Ortho Phosphate as PO_4-P (Water Sol.), mg/Kg	108
% Solids	32.1
Total Carbon, mg/Kg	175,000
Organic Nitrogen, mg/Kg	10,110
Arsenic as As, mg/Kg	<4
Cadmium as Cd, mg/Kg	2.58
Chromium as Cr, mg/Kg	24.7
Copper as Cu, mg/Kg	165
Lead as Pb, mg/Kg	16.2
Mercury as Hg, mg/Kg	1.47
Molybdenum as Mo, mg/Kg	<4
Nickel as Ni, mg/Kg	6.87
Selenium as Se, mg/Kg	4.66
Zinc as Zn, mg/Kg	304

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TO: JBR Consultants
8160 S. Highland Dr. STE A-4
Sandy, Utah 84093

DATE: 10-25-93

SAMPLE ID: Lab #U100924 - Orem Sewage Treatment Plant, Sewage Sludge

DATE SUBMITTED: 10-15-93

CERTIFICATE OF ANALYSIS

PARAMETER	DETECTED
Potassium as K (Water Sol.), mg/Kg	182
Calcium as Ca (Water Sol.), mg/Kg	119
Sodium as Na (Water Sol.), mg/Kg	235
Magnesium as Mg (Water Sol.), mg/Kg	32.8
% Water Holding Capacity	197
DTPA EXTRACTABLES:	
Iron as Fe, mg/Kg	349
Zinc as Zn, mg/Kg	41.6
Copper as Cu, mg/Kg	4.58
Manganese as Mn, mg/Kg	10.2
Cadmium as Cd, mg/Kg	0.31
Lead as Pb, mg/Kg	4.48
Nickel as Ni, mg/Kg	1.38
Chromium as Cr, mg/Kg	0.5

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PHONE: (801) 262-7299
FAX: (801) 262-7378

DATE: 9-17-93

TO: JBR Consultants
8160 S. Highland Dr. STE A-4
Sandy, Utah 84093

PROJECT: Barrick Mercur Sludge Sewage Sludge

DATE SAMPLED: 8-25-93

DATE SUBMITTED: 8-27-93

CERTIFICATE OF ANALYSIS

SAMPLE ID: LAB#:	Aerobic U098526	Anaerobic U098527	DATE ANALYZED/METHOD
PARAMETER			
Water Sol. Potassium as K, mg/Kg	120	56.7	9-08-93 EPA 6010
Water Sol. TKN, mg/Kg	140	780	9-17-93 EPA 351.4
Water Sol. Phosphorus, mg/Kg	115	45.0	9-08-93 EPA 6010
TCLP TEST			
Arsenic as As, mg/l	<.04	<.04	9-01-93 EPA 1311/6010
Barium as Ba, mg/l	4.12	5.89	9-01-93 EPA 1311/6010
Cadmium as Cd, mg/l	0.010	<.01	9-01-93 EPA 1311/6010
Chromium as Cr, mg/l	<.01	<.01	9-01-93 EPA 1311/6010
Lead as Pb, mg/l	0.048	<.02	9-01-93 EPA 1311/6010
Mercury as Hg, mg/l	<.0002	0.00033	8-31-93 EPA 1311/7470
Selenium as Se, mg/l	<.04	<.04	9-01-93 EPA 1311/6010
Silver as Ag, mg/l	<.01	<.01	9-01-93 EPA 1311/6010

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INTERWEST
ANALYTICAL
LABORATORIES

Report Date: 25-Oct-93
Account No.: 4004
Order No: 2260
Date Received: 15-Oct-93

Certificate of Analysis

For: Orem Waste Water Treatment Plant
Keith Scott
955 North 900 West
Orem, Utah 84057

Tests Started:
15-Oct-93

Sample Name: DM Sludge #3
Collected 10-15-93 by NM

Fecal Coliform (SM9221E)(MPN) .... < 50 **MPN/g. dry wt.**

Approved by: Dale Hagelbert

INTERWEST
ANALYTICAL
LABORATORIES

Report Date: 25-Oct-93
Account No.: 4004
Order No: 2259
Date Received: 18-Oct-93

Certificate of Analysis

For: Orem Waste Water Treatment Plant
Keith Scott
955 North 900 West
Orem, Utah 84057

Tests Started:
18-Oct-93

Sample Name: DM Sludge #4
Collected 10-18-93 by NM

Fecal Coliform (SM9221E)(MPN) .... < 50 **MPN/g. dry wt.**

Sample Name: DM Sludge #5
Collected 10-18-93 by NM

Fecal Coliform (SM9221E)(MPN) .... < 50 **MPN/g. dry wt.**

Sample Name: DM Sludge #6
Collected 10-18-93 by NM

Fecal Coliform (SM9221E)(MPN) .... < 50 **MPN/g. dry wt.**

Approved by: [signature]

INTERWEST
ANALYTICAL
LABORATORIES

Report Date: 25-Oct-93
Account No.: 4004
Order No: 2259
Date Received: 18-Oct-93

Certificate of Analysis

For: Orem Waste Water Treatment Plant
Keith Scott
955 North 900 West
Orem, Utah 84057

Tests Started:
18-Oct-93

Sample Name: DM Sludge #7
Collected 10-18-93 by NM

Fecal Coliform (SM9221E)(MPN) .... < 50 **MPN/g. dry wt.**

Sample Name: DM Sludge #8
Collected 10-18-93 by NM

Fecal Coliform (SM9221E)(MPN) .... < 50 **MPN/g. dry wt.**

Sample Name: DM Sludge #9
Collected 10-18-93 by NM

Fecal Coliform (SM9221E)(MPN) .... < 50 **MPN/g. dry wt.**

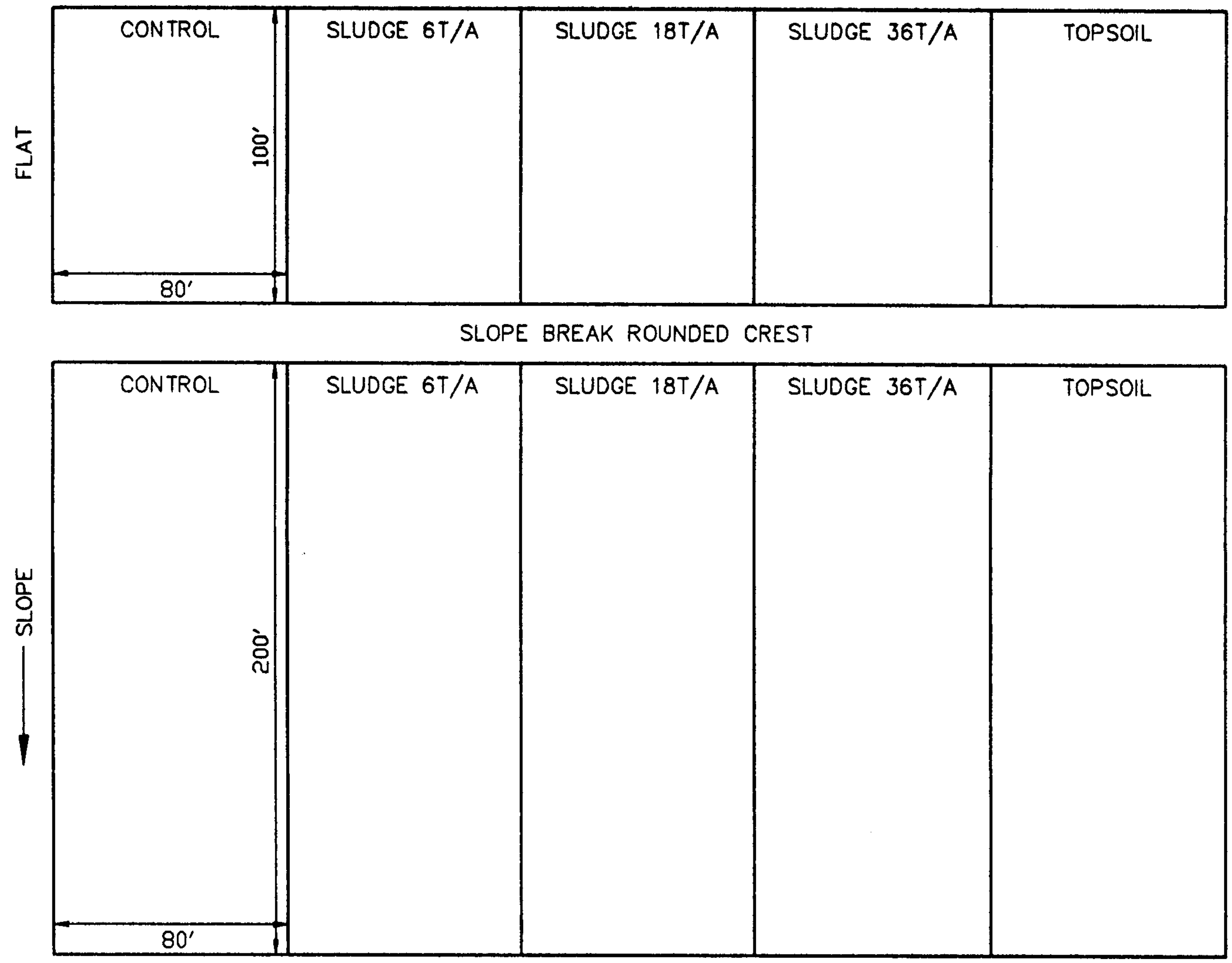
Approved by: ______________

BARRICK RESOURCES CORPORATION
MERCUR GOLD MINE

FIGURE 1
WASTE DUMP TEST PLOT AREAS
CARRIE STEELE WASTE ROCK DUMP

jbr CONSULTANTS GROUP
SALT LAKE CITY, UTAH

DESIGN BY JMJ	DRAWN BY CLP	CH'D BY	SCALE 1" = 200'	DATE DRAWN 10/21/93
				REVISION



BARRICK RESOURCES CORPORATION
MERCUR GOLD MINE

FIGURE 2
MONITORED TEST PLOT DESIGN
CARRIE STEELE WASTE ROCK DUMP

JBR CONSULTANTS GROUP
SALT LAKE CITY, UTAH

DESIGN BY JMJ	DRAWN BY CLP	CH'D BY	SCALE 1"=60'	DATE DRAWN 10/21/93
				REVISION